ASTER and beyond

Anne B. Kahle, David A. Nichols[1]

The use of multispectral thermal infrared remote sensing has been recognized for a number of years, but advancement has been limited by lack of sensors. At last, high spatial resolution orbital multispectral thermal infrared data will become generally available with the launch of ASTER in 1998.

ASTER is a facility instrument provided for NASA's EOS AM-1 platform by the Japanese Ministry of International Trade and Industry (MITI). The instrument has three separate subsystems, which can be operated independently. These are the visible and near-infrared (VNIR) subsystem with three wavelength channels at 15 m spatial resolution, the short wavelength infrared (SWIR) subsystem with six wavelength channels at 30 m resolution, and the thermal infrared (TIR) subsystem with five wavelength channels at 90 m resolution. The VNIR includes a single spectral band (0.76-0.86 μm) radiometer inclined backward at an angle of 27.6° to the other sensors to provide a same-orbit stereoscopic imaging capability.

A wide dynamic range and multiple gain settings will help ensure useful data for a variety of investigations. The swath width for all three systems is 60 km. The cross-track observing range on the ground is approximately ±136 km ensuring that any point on the globe is accessible at least once every 16 days for the SWIR and TIR. Standard data products will include (among others) surface radiance in all wavelength regions, surface kinetic temperature, surface emissivity, and a limited number of Digital Elevation Models (DEMs).

Currently there are no plans for any NASA program to provide an instrument with high spatial resolution (pixel size less than 100 m) operating in the thermal infrared spectral region in the post EOS-AM1 era.

An instrument that we are seeking to develop (Sacagawea) will exploit advanced technologies in optics materials, detectors and coolers to produce TIR data at a significantly reduced cost as compared to the ASTER TIR instrument. Silicon carbide optics and metering structure will minimize weight. Broadband quantum-well infrared photodetectors (QWIPs) in a pushbroom configuration will provide the necessary sensitivity at a much lower cost and risk than HgCdTe detectors. Sacagawea will employ a mirror assembly that will provide a blackbody and space look measurements for a two point calibration at the beginning and end of each observation sequence. Detector uniformity and stability will eliminate the need for a line-by-line calibration mode.

[1] Jet Propulsion Laboratory, Pasadena, CA